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DESIGNING A TTL VOLTAGE LEVEL LOGIC PROBE BY USING COMMON ANODE SEVEN SEGMENT DISPLAY AND AN INVERTING LOGIC GATE ON PROTEUS ISIS 7 PROFESSIONAL[8]

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ABSTRACT

This article will discuss the designing of TTL Voltage Level logic probe. The main components of this equipment or probe are a decoder and a common anode seven segment display and an inverting logic gate. It will display the logic level of a TTL devices output appropriately on a common anode seven segment display. A high voltage on a device output will be displayed as “H” character and a low level output voltage will be displayed as “L” character.

KEYWORDS: 7-Segment Displays, 7 Segment LEDs

INTRODUCTION

Preface

In various experiments of digital logic, the input or the output voltage of a logic gate will be obtained by measuring the input or the output voltage level of it by using an AVO-Ampere Voltage Ohm meter (volt meter in this case). Some Laboratory manuals suggest the use of a LED as an indicator of that logic gate voltage level. However on this occasion the author offered the use of seven-segment display to display the logic level of it.

Main

Figure 1 shows a picture of a “NOT” logic gate experiment by using both LED-Light Emitting Diode and seven segment display as the output voltage level indicators of a NOT gate output voltage.
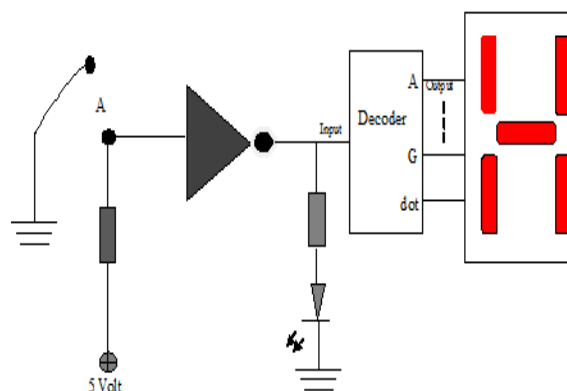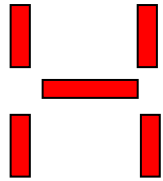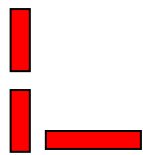
Figure 1: The Experiment Circuits of a NOT Logic Gate[8]

In this paper the authors will discuss the design of a logic probe and use it to measure or display the voltage level of a NOT logic gate output voltage.

From figure 1 above, we expecting the results of the experiment will look as shown in the table below.

Table 1: The Result of the Experiment [8]

Switch (A)	Input A Logic Level	LED	Seven Segment
Open	1	ON	
Close	0	OFF	

The type of the seven segment display used in this experiment is Common Anode Seven Segment Display (common anode) as shown in Figure 2 below.
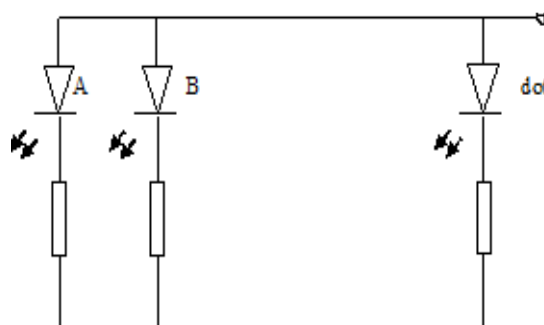
Figure 2: Seven Segment Display in a *Common Anode* Structure[8]

To be able to produce a display as shown in Figure 1 one needs to design the driver / decoder of the display that can produce the output display as expected.

To design a driver / decoder as shown in Figure 1 it is useful to look at the tables 2 below.

Table 2: Designing of the *Driver/Decoder*[8]

Input	Display	Output							
		A	B	C	D	E	F	G	dot
0	L	1	1	1	0	0	0	1	1
1	H	1	0	0	1	0	0	0	1

To be able to fill in the output of table 2 above (before filled by the author) we need to understand the structure of the LEDs that form the common anode seven segment display as shown in figure 4 below.

Figure 3 below shows the physical form of the seven segment display.
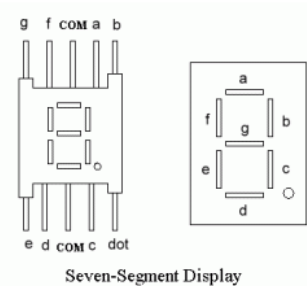
Figure 3: Source [3]
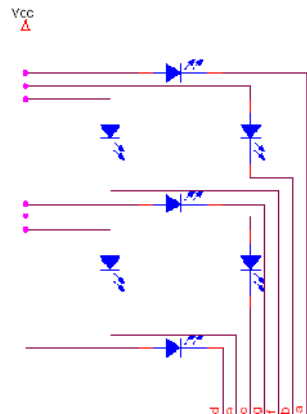
Figure 4: The Diode Structure that Formed the Common Anode Seven Segment Display [7]

From both Figures 3 and 4 above it can be clearly seen that in order to display the L (0) character, segment F, E, and D need to get a logic 0 to make them lit and the rest of the segments to get logic 1 in order to get an off status, however to display the character H (1) segment A, D, and the dot should get a logic 1 (H) to put them in off status and the other segment should get a logic 0 (L) in order to light up as shown in table 2 above. From Table 2: Above the *driver/decoder* can be designed as follow, Or as summary it can be re-written as follows,

Table 3

A = 5 Volt
B = Inver of the INPUT
C = Inver of the INPUT
D = Input
E = 0 Volt
F = 0 Volt
G = Inver of the INPUT
Dot = 5 Volt

- A=dot=5Volt
- B=C=G= Inver of the INPUT
- D=INPUT
- E=F= 0 Volt

From the above discussion we can make the complete circuit of the *decoder/driver* as shown in the figure 5 below.
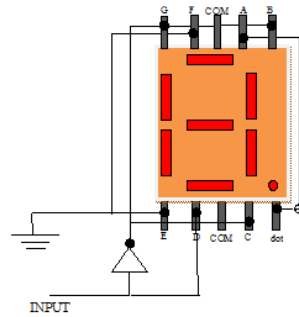
Figure 5: The Complete Circuit of Driver/Decoder and the Display[8]

Proteus ISIS Professional

By using Proteus ISIS Professional, the result of simulation of the *designed logic probe* of measuring or probing the logic level of high and low input voltage are shown in figure 6 and 7 consecutively.
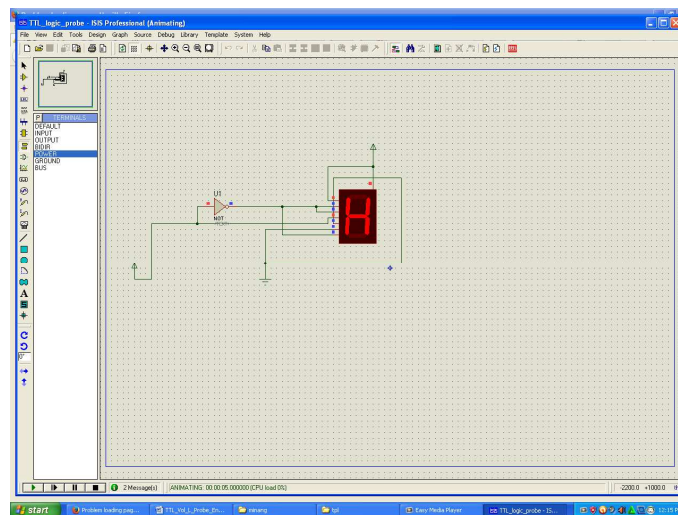
Figure 6: The Result of Simulation of Measuring a High Input Voltage (5Volt/VCC) Using the Designed Probe Running on Proteus ISIS Professional[9]
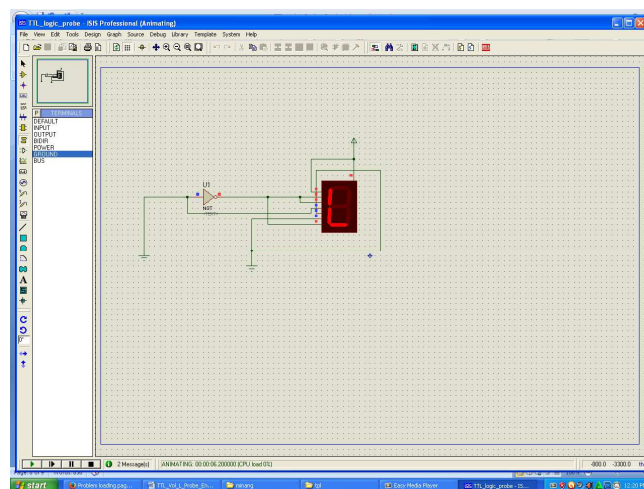
Figure 7: The Result of Simulation of Measuring a Low Input Voltage (GND) Using the Designed Logic Probe Running on Proteus ISIS Professional[9]

Closing

This paper is expected to enable student to build this kind of probe cost efficiently and use it to observe the logic output or input of a logic gate more efficiently and contribute knowledge to science, particularly in the field of Digital Electronics and Computers (Hardware). Also expected to help the students, hobbyist of Digital Electronics can use it both at the Digital laboratory session and other applications.

CONCLUSIONS

From the above discussion some conclusion can be obtained as follows,

- The probe can be used to display the logic level of both TTL logic output and input
- An inverting gate is needed
- A common anode display is needed to build the probe
- A 5 Volt battery or power supply is needed
- The Proteus ISIS professional can runs the operating function or simulation of the designed logic probe

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